# JAPANESE / ENGLISH TRANSLATION OF

## Japanese Patent Application JP 9 – 66590 A

## Sheets for IC Card

Your Ref: No. 1251

For: Eastman Chemical Company

BEST AVAILABLE CO

(19) Japanese Patent Office (JP)

(11) Unexamined Patent Application No: Kokai 9-66590

(12) Unexamined Patent Gazette (A)

(43) Date of Publication: March 11, 1997

| (51) Int. Cl.[6] | | Class. Symbols | Internal Office Registration Nos.: | FI | | Technical Classification Field |
|---|---|---|---|---|---|---|
| B 32 B | 27/36 | | | B 32 B | 27/36 | |
| B 42 D | 15/10 | 521 | | B 42 D | 15/10 | 521 |
| G 06 K | 19/077 | | | G 06 K | 19/02 | |
| | 19/02 | | | | 19/00 | K |

Request for Examination: Not yet submitted  Number of Claims: 2 OL  (Total of 4 pages [in original])

(21) Application No.: 7-224313

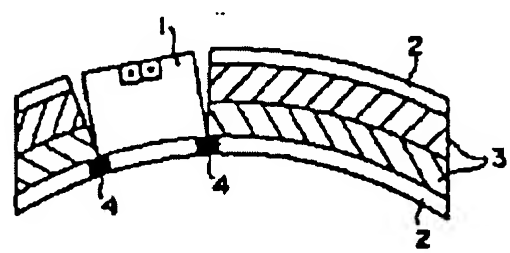
(22) Date of Filing: August 31, 1995

(71) Applicant: 000002141
Sumitomo Bakelite Co., Ltd.
2-5-8 Higashi Shinagawa
Shinagawa-ku, Tokyo

(72) Inventor: Masao KIMATA
c/o Sumitomo Bakelite Co., Ltd.
2-5-8 Higashi Shinagawa
Shinagawa-ku, Tokyo

## (54) [Title of the Invention] Sheets for IC Card

## (57) [Summary]




**[Object]** To provide a core sheet and an over-sheet for an IC card, wherein cracks do not occur in the corner portions where the module and the sheets used in the IC card have been bonded, even if the card is bent.

**[Means of Achievement]**

**[Merits]** A core sheet and over-sheet for an IC card composed of polyethylene terephthalate resin, with the sheets for an IC card being characterized in that the polyethylene terephthalate resin comprises a copolyester resin composition wherein 10 to 70% of the ethylene glycol component of the polyethylene terephthalate resin is replaced by cyclohexanedimethanol, and that at least one side of a sheet is embossed to a surface roughness Ra of 0.5 to 15 μm; and with

the sheets for an IC card further being characterized by comprising a composition wherein 1 to 15 parts of a white pigment is added to 100 parts by weight of the copolyester resin.

**[Claims]**

**[Claim 1]** A core sheet and over-sheet for an IC card composed of polyethylene terephthalate resin, said sheets for an IC card being characterized in that said polyethylene terephthalate resin comprises a copolyester resin composition wherein 10 to 70% of the ethylene glycol component of said polyethylene terephthalate resin is replaced by cyclohexanedimethanol, and that at least one side of a sheet is embossed to a surface roughness Ra of 0.5 to 15 μm.

**[Claim 2]** The sheets for an IC card according to Claim 1, characterized by comprising a composition wherein 1 to 15 parts of a white pigment is added to 100 parts by weight of a copolyester resin wherein 10 to 70% of the ethylene glycol component of said polyethylene terephthalate resin is replaced by cyclohexanedimethanol.

**[Detailed Description of the Invention]**

**[0001]**

**[Technological Field of the Invention]** The present invention relates to sheets for IC cards that are used in IC cards in which a module internally equipped with an IC chip or other component has been mounted.

**[0002]**

**[Prior Art]** In recent years, IC cards have come to be more widely used in various fields because of their larger storage capacity in comparison with conventional magnetic strip cards. The materials used in IC cards commonly comprise a white-colored middle layer referred to as a core sheet, and transparent over-sheets that are laminated to the surface layers of the core sheet, and coated in pairs on the obverse and reverse sides of the card. The core sheet consists of one or two layers; the surface in contact with the over-sheet is commonly printed by offset printing, silk screen printing, gravure printing, or another printing method; and the bonding of the laminated surface of the core sheet and the over-sheet is sometimes performed by dry lamination using a heat fusion method, or by press bonding with the aid of a heat-fusion adhesive. Examples of characteristics required in a sheet for an IC card include print ink adhesiveness, finish

characteristics of the ink impression, suitability to printing machines, and other characteristics related to printing; rigidity, impact strength, tensile strength, elongation, flexural characteristics, and other factors related to mechanical strength; heat resistance, heat fusion characteristics, and other characteristics related to heat; thickness precision, dimensional precision for cutting, smoothness, and other factors related to precision; and punch characteristics and other characteristics.

**[0003]** Such IC cards will inevitably be carried in the pocket of a jacket or trousers, so it is readily apparent that the bending deformation of the cards will change in accordance with the location in which they is carried. Fig. 1 shows a cross-section of an IC card whose obverse side is bent outward, and Fig. 2 shows a cross-section of an IC card whose reverse side is bent outward. In the diagram, 1 is a module that is internally equipped with an IC chip, 2 is an over-sheet, and 3 is a core sheet. Vinyl chloride sheets are commonly used as such sheets in IC cards, principally because their ease of coloring, good printing characteristics, good heat fusion characteristics, good embossing characteristics, good bend workability and punch characteristics, and the like are superior to or better balanced in comparison with other resins, in addition to the fact that they are good general-use resins and are inexpensive to manufacture. However, the card will bend in accordance with the manner in which the IC card is carried, and such an embedded-module structure has a drawback in that cracks may readily occur in the corner portions 4 where the sheet for an IC card and the module are bonded, as shown in Figs. 1 and 2.

**[0004]**

**[Problems to Be Solved by the Invention]** It is an object of the present invention to provide a core sheet and an over-sheet for an IC card in which cracks do not occur in the corner portions where the module and the sheets used in the IC card have been bonded, even if the card is bent.

**[0005]**

**[Means Used to Solve the Above-Mentioned Problems]** The present invention provides a core sheet and over-sheet for an IC card composed of polyethylene terephthalate resin, with the sheets for an IC card being characterized in that the polyethylene terephthalate resin comprises a copolyester resin composition wherein 10 to 70% of the ethylene glycol component of the polyethylene terephthalate resin is replaced by cyclohexanedimethanol, and that at least one side

of a sheet is embossed to a surface roughness Ra of 0.5 to 15 μm; and the sheets for an IC card are further characterized by comprising a composition wherein 1 to 15 parts of a white pigment is added to 100 parts by weight of the copolyester resin.

**[0006]** Fig. 1 shows a cross-section of an IC card whose obverse side is bent outward, and the maximum compressive stress by bending deformation occurs at the corner portion 4 where the over-sheet 2 for an IC card and the module 1 internally equipped with an IC chip are bonded. Fig. 2 shows a cross-section of an IC card whose reverse side is bent outward, and the maximum tensile stress by bending deformation occurs at the corner portion 4 where the over-sheet 2 for an IC card and the module 1 internally equipped with an IC chip are bonded, in the same manner as described above. In other words, it is apparent that maximum stress occurs in the over-sheet 2 for an IC card positioned on the reverse side of the module 1 when an IC card is subjected deformation by bending, as shown in Figs. 1 and 2.

**[0007]** The copolyester resin of the present invention uses a resin in which 10 to 70% of the ethylene glycol component in the polyethylene terephthalate resin is replaced by cyclohexanedimethanol, but if the quantity of ethylene glycol component replaced is less than 10% and bonding or fusion is used, selecting an adhesive will be difficult or the heat fusion properties will be inferior, and the modulus of elasticity of the sheet after fusion will decrease. This is due to the fact that the copolyester resin is a crystalline resin, and the heat fusion characteristics therefore disappear when the sheet recrystallizes during cooling after fusion, and the elasticity of the sheet decreases. If, on the other hand, the quantity of ethylene glycol component that is replaced exceeds 70%, the modulus of elasticity of the copolyester resin will decrease, and when bonding or heat fusion is used, selecting an adhesive will be difficult or the heat fusion properties will be inferior. This is due to the fact that when the replaced quantity of copolyester resin is considerable, recrystallization proceeds rapidly, the heat fusion characteristics disappear, and the elasticity of the sheet decreases. In other words, by having only 10 to 70% of the ethylene glycol component replaced by cyclohexanedimethanol, the copolyester resin becomes a non-crystalline resin, becomes endowed with heat fusion characteristics, and the loss of sheet elasticity is eliminated. The quantity of ethylene glycol component that is replaced by cyclohexanedimethanol should be 10 to 70%, but 20 to 35% is preferable.

[0008] There are no particular limitations as to the methods used to form this copolymer resin into a sheet, with examples including calendering, extrusion, and pressing. An anti-blocking agent may be added to this copolymer resin. Common blocking agents such as talc and calcium carbonates may be used. Titanium oxide, zinc oxide, titanium oxide/barium sulfate, titanium oxide/calcium sulfate, or titanium oxide/magnesium silicate may be added as the white pigment in the core sheet of the present invention. One to fifteen parts by weight of the white pigment is preferably added to 100 parts by weight of the copolyester resin. It is unsuitable for the content of the white pigment as expressed in terms of percentage to be less than 1 part by weight because the whiteness of the card will be inadequate; it is also unsuitable for the content of the white pigment as expressed in terms of percentage to exceed 15 parts by weight because the productivity of the sheet formation will decrease, and heat fusion characteristics will become difficult to obtain. When the copolymer resin is formed into a sheet, one side or both sides are embossed to a surface roughness Ra of 0.5 to 15 μm, but if embossing is not performed, blocking becomes an impediment when the card is manufactured. If the surface roughness exceeds 15 μm, print ink adhesiveness, finish characteristics of the ink impression, suitability to printing machines, and other characteristics related to printing will be reduced, thereby hindering the manufacturing of the card.

**[0009]**

**[Working Examples]**

(Working Example 1) An over-sheet having a thickness of 0.1 mm was rolled into the form of a sheet by calendering copolyester resin in which 30% of the ethylene glycol component of the polyethylene terephthalate resin was replaced by cyclohexanedimethanol. Next, 2.3 parts by weight of titanium oxide was added to 100 parts by weight of the copolyester resin, and the blended composition thereof was rolled into the form of a sheet by calendering, yielding a core sheet having a thickness of 0.7 mm. The resulting core sheet and over-sheet were heat-fused to obtain a sheet for an IC card. Bending deformation was applied to each of the IC cards composed of the sheet for an IC card obtained in accordance with the present invention, as shown in Figs. 1 and 2, but cracks were not observed in the corner portions in contact with the module internally equipped with an IC chip and the over-sheet, nor was any damage to the IC module observed. The resulting sheet for a card had no drawbacks with regard to ink distortion,

ink discoloration, ink adhesion, or other printing machine characteristics. In a test conducted on the IC card in accordance with ISO standards, the tensile strength of the over-sheet for an IC card achieved a value equal to or greater than the ISO standard of 47.1 N/mm$^2$, no cracks in the sheet for an IC card or damage to the IC module were observed in any of the tests for dynamic durability, which are defined as flexing 20 mm in the lengthwise direction 30 times/minute × 1000 times, flexing 10 mm in the lengthwise direction 30 times/minute × 1000 times, and twisting 30 times/minute × 1000 times.

**[0010] (Comparative Example 1)** An over-sheet having a thickness of 0.1 mm was rolled into the form of a sheet by calendering copolyester resin in which 2% of the ethylene glycol component in the polyethylene terephthalate resin was replaced by cyclohexanedimethanol. Next, 2.3 parts by weight of titanium oxide was added to 100 parts by weight of the copolyester resin in which 30% of the ethylene glycol component of the polyethylene terephthalate resin was replaced by cyclohexanedimethanol, and the blended composition thereof was rolled into the form of a sheet by calendering, yielding a core sheet having a thickness of 0.7 mm. It was impossible to heat-fuse the resulting over-sheet to the core sheet.

**(Comparative Example 2)** An over-sheet having a thickness of 0.1 mm was rolled into the form of a sheet by calendering copolyester resin in which 30% of the ethylene glycol component of the polyethylene terephthalate resin was replaced by cyclohexanedimethanol. Next, 20 parts by weight of titanium oxide was added to 100 parts by weight of the copolyester resin, and the blended composition thereof was rolled into the form of a sheet by calendering, yielding a core sheet having a thickness of 0.7 mm. It was impossible to heat-fuse the resulting core sheet to the over-sheet.

**(Comparative Example 3)** An over-sheet having a thickness of 0.1 mm was rolled into the form of a sheet by calendering copolyester resin in which 30% of the ethylene glycol component of the polyethylene terephthalate resin was replaced by cyclohexanedimethanol. Next, 0.5 parts by weight of titanium oxide was added to 100 parts by weight of the copolyester resin, and the blended composition thereof was rolled into the form of a sheet by calendering, yielding a core sheet having a thickness of 0.7 mm. A considerable amount of discoloration occurred in the resulting sheet for an IC card after fusion by heat that was applied during fusion.

**(Comparative Example 4)** An over-sheet having a thickness of 0.1 mm was rolled into the form of a sheet by calendering copolyester resin in which 30% of the ethylene glycol component of

the polyethylene terephthalate resin was replaced by cyclohexanedimethanol. Next, 2.3 parts by weight of titanium oxide was added to 100 parts by weight of the copolyester resin, in which 90% of the ethylene glycol component of the polyethylene terephthalate resin was replaced by cyclohexanedimethanol, and the blended composition thereof was rolled into the form of a sheet by calendering, yielding a core sheet having a thickness of 0.7 mm. It was impossible to heat-fuse the resulting core sheet to the over-sheet.

**[0011] (Comparative Example 5)** The additives shown below (in parts by weight) were added to 100 parts by weight of polyvinyl chloride resin, and the blend composition thereof was rolled into the form of a sheet by calendering, yielding an over-sheet having a thickness of 0.1 mm. Furthermore, 2.3 parts by weight of titanium oxide was added to 100 parts by weight of the same blended composition, and the blended composition thereof was rolled into the form of a sheet by calendering, yielding a core sheet having a thickness of 0.7 mm.

| | |
|---|---|
| Polyvinylchloride resin | 100 |
| Octyltin mercapto-based stabilizer | 3.0 |
| Aliphatic lubricant | 0.5 |
| MBS resin | 10 |

As shown in Figs. 1 and 2, damage to the IC module was observed when bending deformation was applied to each of the IC cards in which the over-sheet and core sheet were used, but cracks were observed in the corner portions in contact with the over-sheet for an IC card and the module internally equipped with an IC chip. In a test conducted on the IC card in accordance with ISO standards, the tensile strength of the over-sheet for an IC card achieved a value equal to or greater than the ISO standard of 47.1 N/mm$^2$, but in the test for dynamic durability in which the card was twisted 30 times/minute × 1000 times, cracks were observed in the corner portions in contact with the over-sheet for an IC card and the module internally equipped with an IC chip.

**[0012]**

**[Effect of the Invention]** The present invention is able to provide a sheet for an IC card, wherein the repeated bending of the IC card does not cause cracks to form in the area of the corners of the bonding portion between the over-sheet and the module of the IC card.

**[Brief Description of the Drawings]**

**[Figure 1]** This diagram shows a cross-section of an IC card whose obverse side is bent outward.

**[Figure 2]** This diagram shows a cross-section of an IC card whose reverse side is bent outward.

**[Key]**

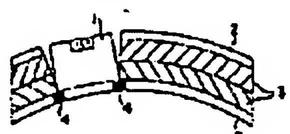
1: Module

2: Over-sheet

3: Cover sheet [sic]

4: Corner portion

**[Figure 1]**



**[Figure 2]**